

EXAMINATION TO THE ADDITIONAL COSTS FOR THE CONSTRUCTION OF LOW ENVIRONMENTAL IMPACT HOUSES: A REAL CASE OF STUDY

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ABSTRACT

Environmental performance of buildings is based on social, human, technical and economic aspects to promote sustainability. The technical actions, such as bioclimatic design, adequate flows of energy and water in heating and cooling systems, a specialised selection of construction materials, etc., involve a non conventional way to build, and so, its costs are unknown. An approach focused on the economical influence of these specific criteria would make possible that owners and other public and private sectors put these products into service and place it on the market.

This case study provides an analysis and economic evaluation of different alternatives, specifying separately the influence of each criteria. Therefore the study includes a cost evaluation of all processes, passive and active systems of solar energy, items of bioclimatic design, the use of low environmental load construction materials, rain water system, solar heating, natural and passive cooling, plants as fence and microclimate effect, etc. The analysis comprises the real cost obtained from three low environmental impact houses, recently finalised, compared with the standard building in the city of Valladolid, in Spain.

Keywords: environmental housing, economic evaluation, bioclimatic design, selection materials.

1. Sustainable construction is a widely noticeable aim to reduce pollution and other environmental problems. One of the main drawback to build in a sustainable way is the lack of economical references and evaluations in terms of over cost on budget. But, How much is this additional cost in comparison with a conventional building? Do all the parameters increase the same? Does any criteria reduce the cost? The present research work tries to answer these questions, through the followed research lines:

2. The description of the physical range:

2.1: Explanation of place: a low impact construction composed of three terrace houses of 175 m² each one, with conventional family program, from a private promotion in a residential area of the centre of Spain (Valladolid), recently finished.

2.2. Definition of green devices and sustainable criteria of the building, such as

2.2.1. Bioclimatic design solutions

2.2.2. Selection of construction materials of less environmental impact.

2.2.3. Passive and active solar energy systems, both thermal and photovoltaic.

2.2.4. Water and plants systems to create microclimate effect.

2.3. Identification of elements and products of conventional construction in a reference building. This is an ideal construction with the same characteristics as our low impact building, but hypothetically made with conventional systems and materials in the same area.

2.4. Application and comparison of costs: the cost of the low impact building compared with the cost of the reference building.

3. Conclusion: Building in a sustainable way has increased the price more than a 27 % than a conventional system, in this particular case and circumstances. The total cost of a conventional operation is calculated in about 780-800 € per m². Although, the total cost of this low impact building reaches 991 € per m². Granted that, some comments must be done:

First of all, we must split up the conclusion in two different parts. One of them, those which do not mean an over cost, such as an adequate size, shape and orientation North-South. All of them are bioclimatic solutions of design. Secondly, those which can reduce construction cost, such as PP and PE sewers (which reduce a small 0.03 % of total budget), flooring systems of low burning (0.55 % of reduction of total budget), natural wood varnish (0.08 %) , natural stones (0.70%) , water based paintwork (0.54 %), and gardening partitioning instead masonry partitioning (which saves 0.77% of total budget).

In opposition of that, those which are related inside the chapter of active solar energy have an unavoidable over cost, near to 12.34 % of total budget. The cost of green house and the *trömbe* wall increases the budget in a 1.83 % and 1.44 % respectively. Other inputs are more related to wrong policies and market changes than with materials cost themselves, as it is the case of wood frames, which support an over cost of 4.41% of budget.



Picture1. South facade and atrium